

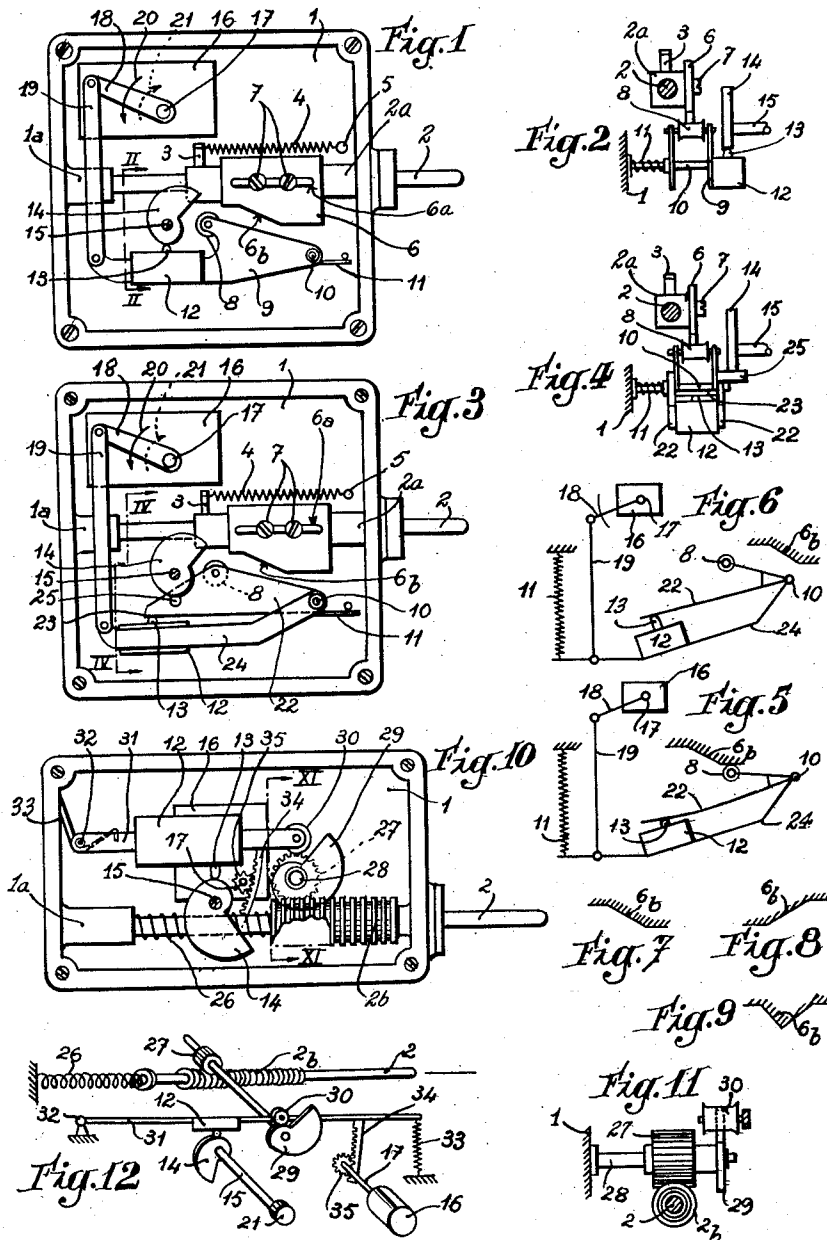
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PUSH-ROD SWITCHES

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PUSH-ROD SWITCHES

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This invention refers to electric switches actuated by a slidable pusher rod, of the kind described in my prior patent application Serial No. 798,419 now Patent No. 2,997,565, Aug. 22, 1961. These switches are frequently used for initiating an operation when a movable member has reached a pre-determined position, as for instance when a carriage has completed its stroke. In such a case the carriage or like member pushes the pusher rod of the switch, whereby the inner snap-acting contacts of the latter are closed, or respectively opened, as the case may be. When the carriage moves in the reverse direction the pusher rod is released and the inner contacts open, or respectively close.

It is sometimes desired that the electric circuit controlled by the switch should remain closed, or open, notwithstanding the fact that the movable carriage has released the pusher rod of the switch. This of course may be obtained by means of an auxiliary relay pivoted with a retaining or self-energizing contact, but this solution is relatively expensive.

A first object of the present invention is to provide a push-rod switch wherein the circuit controlled by the switch may remain closed, or respectively open, during a pre-determined time after the pusher rod of the switch has been pushed by a movable carriage or like member.

Another object of this invention is to provide a push-rod switch wherein the circuit controlled by the switch is only closed, or respectively opened, when the pusher rod of the switch is released by the movable carriage or like device and thereafter remains closed, or respectively open for a pre-determined time.

In accordance with a first aspect of the present invention in a push-rod switch of the kind comprising a slidable pusher rod, a pivotally mounted micro-switch unit urged against an adjustable abutment to cause the latter to depress the actuating push-button of the micro-switch unit, and cam and follower means disposed between the pusher rod and the micro-switch unit to move the said unit away from the said adjustable abutment to release the said actuating push-button, there is provided a retarding mechanism which after the micro-switch unit has been liberated from the action of the cam and follower means, retards the return of the said micro-switch unit against the adjustable abutment.

It will be appreciated that with such an arrangement the snap-acting contacts of the micro-switch unit are actuated as soon as the pusher rod is pushed, as for instance by a movable carriage, but that these contacts are only re-actuated in the reverse direction a pre-determined time after the pusher rod has been released by the movable carriage or like device.

According to a further aspect of the present invention the cam and follower means may act on an intermediate pivoted member interposed between the actuating push-button of the micro-switch unit and the adjustable abutment. With this arrangement when the pusher rod of the switch is actuated, the cam and follower means actuate the intermediate member which in turn moves the micro-switch unit by action on the push-button thereof, i.e. without modifying the position of the inner contacts of the said micro-switch unit. When the pusher rod is released, the micro-switch unit is retained by the retarding mechanism which delays its return movement and its

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push-button is therefore librated from the pressure of the intermediate member which is no more urged by the cam and follower means, whereby the inner contacts of the said unit are actuated. After a predetermined time the push-button again engages the intermediate member which is retained by the adjustable abutment and the inner contacts are re-actuated in the reverse direction.

In the annexed drawings:

FIG. 1 is a view in elevation showing a first embodiment of a push-rod switch according to the present invention.

FIG. 2 is a fragmental section taken along line II—II of FIG. 1.

FIGS. 3 and 4 are views respectively similar to FIGS. 1 and 2, but corresponding to another embodiment comprising an auxiliary intermediate member.

FIGS. 5 and 6 are diagrams illustrating the operation of the switch of FIGS. 3 and 4.

FIGS. 7 to 9 show three possible profiles of the cam member of the switch of FIG. 1 and 2 or of FIGS. 3 and 4.

FIG. 10 shows another embodiment comprising a rotary cam driven by the pusher rod through a rack and pinion gearing.

FIG. 11 is a fragmental section thereof taken along line XI—XI of FIG. 10.

FIG. 12 is a diagram illustrating the operation of the embodiment of FIGS. 10 and 11.

Referring to FIGS. 1 and 2 the push-rod switch comprises a switch case 1 adapted to be closed by a cover not illustrated. A pusher rod 2 is slidable through one of the lateral walls of this case and in an inner boss 1a formed on the facing lateral wall thereof. This pusher rod 2 may be cylindrical in which case it should be prevented from rotating about its own longitudinal axis by any appropriate means not illustrated, as for instance by providing at its free end a square head adapted to slide in a square bore of boss 1a, or by a keyway in the rod and a radially projecting stud carried by the said boss. On the central portion of rod 2 is secured a block 2a of rectangular cross-section the upper side of which has a stud 3 on which is attached one end of a coil spring 4 the other end of which is attached to a gudgeon 5 carried by the rear wall of case 1, the said spring urging pusher rod 2 towards the right in FIG. 1. On the lateral side of block 2a which faces towards the open side of case 1 is secured a cam member 6 in the form of a plate having an elongated opening 6a through which are passed securing screws 7. The lower edge 6b of cam member 6 is adapted to actuate a roller or cam follower 8 carried by a swingable support 9 rotatably supported by a gudgeon 10 secured to the bottom wall of case 1. A torsional spring 11 urges support 9 in a clockwise direction in FIG. 1, whereby follower 8 tends to move upwardly towards cam member 6.

The swingable support 9 carries a micro-switch unit 12 of conventional construction the inner contacts of which are actuated by a push-button 13. Under the action of spring 11 push-button 13 is normally applied and depressed against a normally stationary, but adjustable, cam 14 carried by a shaft 15 itself rotatably supported by the cover (not illustrated) of the switch case, the said shaft carrying an appropriate setting knob.

A retarding mechanism 16 is disposed in the upper part of case 1, as for instance by being secured to the bottom thereof by means not shown. This mechanism is of the kind comprising an inlet shaft 17 which can be rotated freely in one direction, namely the counterclockwise direction in FIG. 1, but which can only be rotated at a very slow speed in the other direction, as for instance by being connected with a clockwork. Shaft 17 carries an

arm 18 which is connected with the swingable support 9 by means of a link 19.

When the pusher rod 2 is pushed towards the left in FIG. 1 against spring 4, the lower edge 6b of cam member 6 engages follower 8 and lowers support 9 against spring 11, this movement being permitted by the retarding mechanism 16 since the inlet shaft 17 thereof then rotates counterclockwise (arrow 20 in full lines). The actuating push-button 13 of the micro-switch unit 12 disengages cam 14 whereby the snap-acting inner contacts of the micro-switch are actuated.

When the pusher rod 2 is released, it is returned to the right by spring 4 and therefore follower 8 is disengaged from cam member 6. Spring 11 tends to return support 9 to its initial position, but this movement is retarded by mechanism 16, shaft 17 now rotating clockwise (arrow 21 in dash lines) and therefore the actuating push-button 13 is only again depressed after a predetermined time. If the switch is actuated by a movable carriage, the circuit controlled by the switch closes (or opens) when the carriage pushes rod 2, it remains closed (or open) during the whole time during which rod 2 is depressed, and it only re-opens (or closes) a given time after the said rod has been released.

In the modification of FIGS. 3 and 4 the cam follower 8 is carried by an intermediate member 22 rotatably mounted on gudgeon 10. This intermediate member is formed of two cheeks connected by a transverse member 23. The micro-switch unit 12 is again supported by a swingable support 24 also pivoted on gudgeon 10, the said support being biased by spring 11, as support 9 of FIGS. 1 and 2. The micro-switch unit 12 is so arranged on support 24 that the actuating push-button 13 normally bears against the transverse member 23 of the intermediate member 22; the latter in turn has a lateral pin 25 which bears against the adjustable cam 14. Support 24 is again connected with mechanism 16 by link 19.

As in the case of FIGS. 1 and 2 the actuating push-button 13 is normally depressed. When the pusher rod 2 is actuated, as for instance by a movable carriage, the cam edge 6b lowers follower 8 and member 22, the latter in turn lowering the micro-switch unit 12 through its push-button 13, together with support 24, this displacement causing shaft 17 to rotate freely (arrow 20). The actuating push-button 13 therefore remains depressed and the inner contacts of the micro-switch are not actuated. FIG. 5 clearly shows the position of the parts at the end of the inward movement of pusher rod 2. In this figure the biasing spring 11 is illustrated as a conventional coil spring.

If now pusher rod 2 is released, spring 11 returns support 24 upwardly at a very slow speed. But since the intermediate member 22 is now free, it is raised by push-button 13 (the weight of member 22 being quite small) and the inner contacts of the micro-switch are actuated (position of FIG. 6). At the end of the returning stroke of support 24, pin 25 again engages cam 14, whereby member 22 is retained against the action of push-button 13. The latter is therefore again depressed.

The circuit controlled by the switch therefore remains open (or closed) when the pusher rod 2 is depressed, as by a movable carriage. It closes (or opens) when the pusher rod is released and remains closed (or open) during a predetermined time after which it re-opens (or re-closes).

FIGS. 7 to 9 illustrate possible conformations or profiles of the cam edge 6b. The profile of FIG. 7 corresponds to the above examples (see FIGS. 1 and 3). In FIG. 8 this profile is reversed, which of course reverses the operations of the switch. FIG. 9 illustrates a double cam which ensures operation of the switch both when its pusher rod is depressed and when it is released.

In the embodiment, of FIGS. 10 and 11 the pusher rod 2 carries a cylindrical portion 2b having peripheral teeth to form a cylindrical rack. Pusher rod 2 is urged out-

wardly by a spring 26 mounted thereon between rack 2b and boss 1a. Rack 2b is in mesh with a pinion 27 rotatably carried by a gudgeon or pin 28 secured to the bottom of the switch case 1. This pinion 27 is rigidly connected with a spiral cam 29 adapted to act on a cam follower 30 carried by a swingable support 31 pivoted on a gudgeon 32 and urged downwardly by a torsional spring 33. The micro-switch unit 12 is secured to support 31 and its push-button 13 bears against the adjustable cam 14 as in the embodiment of FIGS. 1 and 2. A toothed sector 34 is secured to support 31 and engages a pinion 35 keyed on the inlet shaft 17 of the retarding mechanism 16 secured to the bottom wall of case 1.

The operation may be clearly understood from FIG. 12. When pusher rod 2 is pushed inwardly to the left against spring 26, rack 2b rotates pinion 27 and cam 29 and the latter raises support 31. The actuating push-button 13 of the micro-switch unit 12 leaves cam 14 and the snap-acting inner contacts of the switch are actuated. Simultaneously sector 34 rotates pinion 35 and shaft 17 in the free direction (which is here the counterclockwise direction instead of the clockwise direction as in FIGS. 1 and 3). When pusher rod 2 is released spring 33 returns support 31 downwardly at the slow speed prescribed by mechanism 16 and button 13 is not again depressed before a predetermined time.

I claim:

1. A push-rod switch comprising a main support; a pusher rod slidably supported by said main support; a microswitch unit pivotally carried by said main support, said micro-switch unit embodying an actuating push-button and inner snap-acting contacts actuated by said push-button; a normally stationary but adjustable regulating abutment carried by said main support to cooperate with said push-button; spring means to urge said micro-switch unit towards said adjustable abutment to cause said push-button to be depressed by same with respect to said unit; cam and follower means between said pusher rod and said micro-switch unit to move said unit away from said adjustable abutment to release said push-button from the action of said adjustable abutment; a retarding mechanism also carried by said main support, said mechanism having an inlet shaft freely rotatable in a first direction and which can only rotate at a predetermined slow speed in the second direction; and means to connect said micro-switch unit with said inlet shaft to cause said inlet shaft to rotate in said first direction when said micro-switch is moved away from said adjustable abutment against said spring means and to rotate in said second direction when said micro-switch unit is returned towards said adjustable abutment by said spring means.

2. In a push-rod switch as claimed in claim 1, said micro-switch unit being carried by a swingable support pivotally mounted on said main support; and said connecting means comprising an arm on said inlet shaft and a link disposed between said arm and said swingable support.

3. In a push-rod switch as claimed in claim 1, said micro-switch unit being carried by a swingable support pivotally mounted on said main support, said cam and follower means embodying a cam plate secured to said pusher rod to move therewith, said cam plate having a cam edge, and a roller rotatably carried by said swingable support to cooperate with said cam edge; and said connecting means comprising an arm on said inlet shaft and a link disposed between said arm and said swingable support.

4. In a push-rod switch as claimed in claim 1, said micro-switch unit being carried by a swingable support pivotally mounted on said main support; and said connecting means comprising a pinion on said inlet shaft and a toothed sector carried by said swingable support.

5. In a push-rod switch as claimed in claim 1, said micro-switch unit being carried by a swingable support pivotally mounted on said main support; and said cam

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and follower means comprising a cylindrical rack carried by said pusher rod to move therewith; a pinion rotatably carried by said main support to cooperate with said cylindrical rack; a spiral cam associated to said pinion to rotate therewith; and a roller rotatably carried by said swingable support.

6. A push-rod switch comprising a main support; a micro-switch unit pivotally carried by said main support, said micro-switch unit embodying an actuating push-button and inner snap-acting contacts actuated by said push-button; an intermediate member also pivotally carried by said main support to cooperate with said push-button; spring means to urge said micro-switch unit towards said intermediate member to cause said push-button to engage same; a normally stationary but adjustable regulating abutment carried by said main support to cooperate with said intermediate member to retain same against the action of said spring means transmitted by said push-button and to cause depression of said push-button; cam and follower means between said pusher rod and said intermediate member to move same away from said adjustable abutment; a retarding mechanism also carried by said main support, said mechanism having an inlet shaft freely rotatable in a first direction and which can only rotate at a pre-determined slow speed in the second direction; and means to connect said micro-switch unit with said inlet shaft to cause said inlet shaft to rotate in

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said first direction when said micro-switch unit is moved away from said adjustable abutment against said spring means and to rotate in said second direction when said micro-switch unit is returned towards said adjustable abutment by said spring means.

7. In a push-rod switch as claimed in claim 6, said intermediate member and said micro-switch unit being pivoted to said main support substantially about the same axis.

8. In a push-rod switch as claimed in claim 6, said micro-switch unit being carried by a swingable support pivotally mounted on said main support; and said connecting means comprising an arm on said inlet shaft and a link disposed between said arm and said swingable support.

9. In a push-rod switch as claimed in claim 6, said micro-switch unit being carried by a swingable support pivotally mounted on said main support; said cam and follower means embodying a cam plate secured to said pusher rod to move therewith, said cam plate having a cam edge, and a roller rotatably carried by said intermediate member to cooperate with said cam edge; and said connecting means comprising an arm on said inlet shaft and a link disposed between said arm and said swingable support.

No references cited.